SHOREFACE SEDIMENT AVAILABILITY ON NATURAL AND DEVELOPED COASTS

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ABSTRACT
Sediment availability and how sediment is exchanged within a coastal system are key components of coastal resilience, particularly for barrier islands. Geologic assessments that characterize barrier island sediment distribution have focused on terrestrial and continental shelf (water depths >10m) environments (e.g., Raff et al., 2018; Schwab et al., 2014). However, little is known about shoreface sediment distribution (water depths 0-20m; Fig. 1) and to what extent it is linked to coastal change. Most studies that have considered the submerged shoreface have focused on characterizing or modeling morphology (e.g., Cowell and Kinsela, 2018; Turner et al., 2016) and this work has shown the value of shoreface morphologic data in reducing uncertainty in shoreline change predictions (Kinsela et al., 2017). Shoreface geologic data could further reduce uncertainties by quantifying along- and cross-shore variations in shoreface extent that might influence coastal evolution over decadal (e.g., Miselis & McNinch, 2006) and longer timescales. For shorter time scales especially, an important consideration is the response of the shoreface to human actions. Sediment availability can be altered by beach nourishment, hard structures, and artificially tall dunes, all of which will impact sediment exchange from the shoreface to the back-barrier. Understanding how natural and human-induced variability combine to influence shoreface sediment availability could provide insight to future coastal resilience to both storms and sea-level rise.

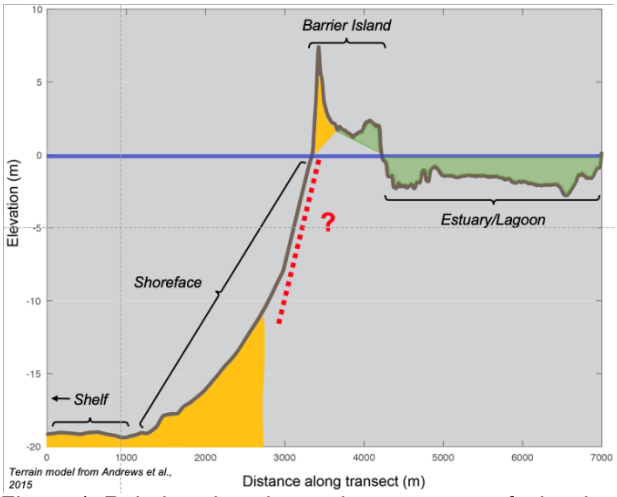

Figure 1. Relative elevation and components of a barrier island system showing a shoreface data gap.

To explore this, we used vessels and equipment adapted for very shallow water depths and conducted shoreface geophysical surveys along three barrier islands on the east coast of the United States with varying degrees of human intervention. Geophysical data reveal 1) variations in shoreface geomorphology between the study areas and 2) differences in the location of the geologically-defined shoreface toe and computed morphodynamic depth of closure (e.g., Ortiz & Ashton, 2016). Further, lack of shoreface sediment at natural and heavily-developed sites relative to a moderately-developed site suggests those barriers will be more reliant on alongshore sediment fluxes as sea levels rise, since landward sediment fluxes cannot be replenished with fluxes from the shoreface. Future work will explore observed and modeled feedbacks between shoreface sediment availability, morphodynamic equilibrium, and human modifications and their impacts to future coastal resilience.

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